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HEADQUARTERS

UNITED STATES ARMY FORCES IN THE FAR EAST
OFFICE OF THE THEATER SURGEON

APO 501
7 May 1945

TECHNICAL MEMORANDUM NO. 4

Techn. Mem. Off. Theater Surg. U.S. Army Forces Far East

TREATMENT OF THORACIC WOUNDS

1. The treatment of chest wounds is directly concerned with measures to restore a sudden disturbance in cardio-respiratory physiology and to control hemorrhage, having in mind at all times the prevention of infection and the prevention of the formation of organizing massive blood clots which will prohibit later expansion of the lung.
2. The three common chest wound emergencies are the sucking wound, tension pneumothorax, and hemorrhage.

a. Sucking wounds. These require immediate closure by suture. Occlusive dressings with pads or adhesive plaster are not airtight. When required by force of circumstance the pad should be composed of vaseline gauze and should be sutured in place.

b. Tension pneumothorax is indicated by signs of increasing dyspnoea, engorgement of the neck veins and developing cyanosis. A single or repeated aspiration of air will usually suffice in treatment but occasionally a short beveled needle of about 15 gauge must be inserted into the 2nd or 3rd interspace anteriorly and left in place with a tube attached leading to an underwater seal or to a finger cot flutter-valve.

c. Hemorrhage. (1) Hemothorax is an almost invariable complication of gunshot or shrapnel wounds of the chest, and it may occur as a result of direct trauma to the chest wall without penetration. The bleeding is usually from vessels within the lung. Unless the amount of parenchyma destroyed is large or vessels near the hilum are involved, bleeding from damaged vessels within the pulmonary parenchyma leads, as a rule, to the relatively slow development of hemothorax. The intercostal or internal mammary arteries are sometimes the source of the hemorrhage. When one or more of these vessels are lacerated, the development of hemothorax may be rapid and continuous.

(2) The treatment of hemothorax has been the subject of some controversy. Recent experience, however, has lead to the establishment of certain principles which are set forth in this memorandum and are given as standard procedure for this theater.

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(a) Aspiration. Early and repeated aspiration of blood without air replacement is essential in the proper management of hemothorax.

1. Immediate aspiration may be necessary to obtain relief when the quantity of blood within the thorax is so great that the lung has been crowded and mediastinum embarrassment has occurred.

2. Even without signs of such embarrassment, aspiration should be made within 24 to 48 hours after injury and repeated as soon as more blood accumulates because of the following reasons:

a. The removal of blood will prevent the organization of deposited fibrin on the pleural surfaces. If such organization is permitted, fibrothorax, with restricted respiratory excursions, will result.

b. Aspiration of blood may prevent empyema or limit the extent of an empyema if it does occur. Accumulated blood is a good nidus for bacterial growth, and the larger the quantity of blood the more extensive will be the empyema.

c. The sooner a collapsed lung is re-expanded the easier and more certain the re-expansion will be.

3. The urgency of aspiration is dictated by evidences of circulatory or respiratory embarrassment. Subsidence of acute symptoms is often obtained only by repeated aspirations, but it may be, in instances where bleeding is relatively slight, arrived at spontaneously. Even though the effusion is too small to produce symptoms, the blood should, nevertheless, be removed after 24 to 48 hours for the reasons stated above.

4. Transfusion is a necessary adjunct to aspiration, and preparations for replacement of blood should be made prior to aspiration. The amount and frequency of transfusion can be determined by the amount of blood removed from the pleural cavity, the amount apparently lost by external bleeding, and the condition of the patient.

5. Rarely in order to prevent recurrence of bleeding due to re-expansion of the lung it may be necessary to replace by air the blood which has been removed. Such air replacement, however, is not often necessary and seldom, if ever, after more than the first aspiration.

6. Penicillin. After each aspiration 100,000 units of penicillin in solution should be injected into the pleural cavity.

7. Precautions. During aspirations the patient's condition should be watched carefully and if undue chest pain, rapid or irregular heart action, weakness or excessive sweating occur the procedure should be discontinued. It should be repeated on an early subsequent day.

(b) Thoracotomy

1. When the hemothorax persists and the thorax refills rapidly with blood there is usually laceration of an intercostal or internal mammary artery, and this can be dealt with best by exposure and suture ligature of the vessel.

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2. If massive hemorrhage into the pleural space continues and is not from the chest wall, open thoracotomy and suture of the lung, or if there has been very extensive damage, lobectomy will be needed.

3. Large intrapleural foreign bodies or debris that is readily accessible may be removed by extension of the wound.

4. Wounds of large bronchi or the intrathoracic portion of the trachea are repaired through a thoracotomy incision.

3. Later complications in chest wounds include residual "clotted hemothorax" and empyema. These complications must be treated only by experienced general surgeons, familiar with thoracic surgery. Patients with chest injuries should, therefore, be evacuated to general hospitals within the theater which are especially designated to treat chest injuries just as soon as these patients can be safely transported.

a. Clotted Hemothorax. The accumulation of massive clots of fibrin in the pleural cavity is suspected when clinical findings persist and only small amounts of blood can be withdrawn with the needle and if in addition, serial roentgenograms show no improvement during the 3d to 6th weeks. In such cases thoracotomy is done for the removal of clots from the pleural cavity and the dense layer of fibrin from the underlying lung. Early decortication in these cases permits normal expansion of the lung and prevents chronic empyema and other complications that lead to chronic disability. Penicillin is used both systemically and locally in the pleural cavity at the time of operation.

b. Empyema. Empyema complicating hemothorax demands prompt surgical intervention by tidal drainage or rib resection, or, when response from these methods of treatment is delayed and when the patient's condition permits, radical thoracotomy with the evacuation of residual clots and decortication of the lung. The latter procedure should be performed preferably before the tenth week, because the surgical line of cleavage becomes obliterated after this time by organization of inflammatory exudate. Systemic and local penicillin is used as an adjuvant.

4. Other important measures in the treatment of chest wounds are:

a. Bronchoscopic or catheter aspiration of blood and mucus from the tracheo-bronchial tree.

b. Infiltration of the intercostal nerves with procain hychloride solution for relief and chest-wall pain. This enables the patient to cough effectively and clear the air passages of blood secretions.

c. Endotracheal oxygen-ether, administered through a closed apparatus capable of maintaining positive pressure, is the form of anesthesia indicated in the operative management of penetrating and perforating chest wounds.

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